

---

# Cost and Performance Summary Report

## Thermal Desorption at the Lipari Landfill, Operable Unit 3

### Pitman, New Jersey

---

#### Summary Information [2]

The Lipari Landfill (Lipari) site was used for disposal of a variety of household, chemical, and other industrial wastes from 1958 to 1971. Approximately 3 million gallons of liquid wastes and 12,000 cubic yards of solid wastes were disposed of in trenches originally excavated for sand and gravel. The wastes included solvents, paints and thinners, formaldehyde, dust collector residues, resins, and solid press cakes from the industrial production of paints and solvents.

The Lipari Landfill was closed by the New Jersey Department of Environmental Protection in 1971 and added to the National Priorities List in September 1983. The site has been addressed through initial actions and three long-term remedial phases focusing on source control, cleanup of groundwater and leachate, and offsite cleanup activities. On-site activities included installation of a security fence, vertical barrier wall, landfill cap, and groundwater extraction and treatment system.

In July 1988, EPA signed a Record of Decision (ROD) to clean up Operable Unit (OU) 3 (offsite contamination) at Lipari, including clean up of areas near the landfill (marsh, aquifers, streams, and lake). The ROD required treatment of contaminated soil and sediment using thermal desorption. A potentially responsible party (PRP) conducted the cleanup under the terms of a Consent Decree. The thermal desorption cleanup is the subject of this report.

Thermal desorption was conducted at the site from September 1994 to September 1995, including a five month downtime to rebuild a baghouse used for treating the off-gas from the thermal desorber. A total of 80,000 tons of contaminated marsh soil and sediment were treated during this application.

CERCLIS ID Number: NJD 980505416

Type of Action: Remedial

Lead: PRP Lead

#### Timeline [1, 3]

July 11, 1988	ROD signed for offsite contamination at Lipari (OU 3)
June 1994	Thermal desorption system mobilized to site
September 1994	Thermal desorption system started operation at full scale
October 7 to November 17, 1994	Testing conducted
November 20, 1994	Baghouse destroyed by fire
November 20, 1994 to April 1995	System shut down while baghouse rebuilt
April to September 1995	System restarted and operated at full scale
May 30 - 31, 1995	Performance testing conducted

#### Factors That Affected Cost or Performance of Treatment [1]

Listed below are the key matrix characteristics for this technology and the values measured for each during site characterization.

#### Matrix Characteristics [1, 5]

Parameter	Value
Soil Classification:	Not provided
Clay Content and/or Particle Size Distribution:	Not provided
Moisture Content:	20 - 30 %
Organic Content:	Not provided
pH:	5
Bulk Density:	Not provided

### **Treatment Technology Description [1, 6]**

The thermal treatment system used for this application was a low temperature thermal desorption (LTTD) system owned by Williams Environmental Services, Inc. The system included a direct-heated rotary kiln; feed metering unit; baghouse; thermal oxidizer; wet quench; acid gas absorber; and control unit that housed the controls, data logger, and analyzers. The desorber was a countercurrent rotary dryer fired by a 49 million BTU/hour burner. The unit was approximately 40 feet long and 8.5 feet in diameter, and was fabricated from 304 stainless steel. Contaminated soil was screened to remove cobbles and rocks greater than 3 inches in length prior to being fed to the desorber. Treated soil was backfilled on site.

The thermal desorption system began operation in September 1994. During startup, the vendor adjusted the system throughput and exit gas and soil temperatures to improve system performance. Testing conducted from October to November 1994 showed elevated levels of particulates in the emissions. New demisters were added to the scrubber which reduced particulate emissions.

On November 20, 1994, there was a fire in the baghouse that was caused by the presence of elevated levels of sulfur pyrite, an indigenous material in the soil processed through the desorber. The elevated operating temperature caused the pyrite to be converted to its anhydrous form, which then reacted with oxygen and caused a fire in the polyimide bags, which caused the baghouse to ignite, resulting in the destruction of the baghouse.

After rebuilding the baghouse and modifying the quench design, operation of the thermal desorption system was resumed on April 22, 1995. Testing conducted May 2 to 5, 1995 showed that particulate emissions were 0.0016 grains per dry standard cubic foot (gr/dscf), below the requirement of 0.03 gr/dscf. A performance test was conducted May 30 to 31, 1995, and showed that particulate emissions were 0.0079 gr/dscf, which were below the requirement of 0.03 gr/dscf.

The high moisture content of the soil limited the amount of material processed through the desorber. To address this concern, lime was added to the soil using a pugmill mixing system to improve the material handling characteristics and to control the emissions of sulfur dioxide to the atmosphere (due to the sulfur in the pyrite mineral).

### **Operating Parameters [1, 5]**

Listed below are the key operating parameters for this technology and the values measured for each.

Operating Parameter	Value
Residence Time	20 minutes (approximate)
System Throughput	311 tons/day (first 4 months) 529 tons/day (remainder of project)
Soil Exit Temperature	733 °F (before October 21, 1994); 850 °F (after October 21, 1994)
Thermal Desorber Exit Gas Temperature	372 °F (average starting on October 21, 1994)
Thermal Oxidizer Exit Gas Temperature	>1,800 °F
Baghouse Differential Pressure	>1 inch w.c.

### **Performance Information [1, 5, 6]**

The ROD for OU 3 did not identify specific cleanup goals for treated soil from the thermal desorber. However, cleanup targets were identified in an Explanation of Significant Differences (ESD). As shown in Table 1, soil cleanup goals were identified for one specific organic compound, bis (2-chloroethyl) ether, for three categories of organic compounds, and for metals. In addition, emission limits were identified by the NJ DEP for organic and inorganic compounds and air quality parameters, as shown in Table 2.

Available performance data for this application is limited to the results of the performance test conducted in May 1995. The results of the performance test, presented in Table 1, show that, with the exception of molybdenum, all soil cleanup targets were met during the test. According to the vendor, the elevated concentrations of molybdenum were due to its use in the grease on the front-end loader used to transport soil.

While no concentration data were provided for treated soil other than for the performance test, the vendor reported that, prior to conducting the performance test, several batches of soil did not meet the cleanup goal for bis (2-chloroethyl) ether. According to the vendor the soil was retreated to meet the cleanup goal.

Information was not provided about contaminant concentrations in the soil prior to treatment. However, Appendix A shows the maximum allowable contaminant concentrations in soil per the NJDEP air permit for the application.

As shown on Table 2, all air emission limits were met during the performance test.

**Table 1. Soil Cleanup Targets and Performance Test Results [1, 5]**

		Performance Test Results		
Compound	Cleanup Target	Run 1	Run 2	Run 3
Volatile Organics - mg/kg				
Trichloroethene	No limit	0.035	ND	ND
Chlorobenzene	No limit	0.0087	0.020	0.0097
Acetone	No limit	0.0068	ND	ND
Benzene	No limit	0.0067	ND	ND
Toluene	No limit	0.013	ND	ND
Total Volatile Organics	1	0.131	0.020	0.0097
Semivolatile Organics - mg/kg				
Bis (2-chloroethyl) ether	0.011	ND	ND	3.4 E-6
Benzoic Acid	No limit	ND	3.00	2.90
Acid Extractables (as phenol)	50	<50	<50	<50
Base/Neutral Extractables	10	<10	<10	<10
Metals (Total) - mg/kg				
Antimony	10	<10	<10	<10
Arsenic	20	ND	5.9	6.2
Barium	400	29	31.5	31.9
Beryllium	1	0.28	0.36	0.37
Cadmium	3	<3	<3	<3
Chromium	100	15.1	17.5	17.5
Copper	170	6.4	7.1	7.5
Lead	500	35.1	32.7	33.4
Mercury	1	<1	<1	<1
Molybdenum	1	3.8	3.1	2.9

Nickel	100	3.7	4.3	4.8
Selenium	4	<4	<4	<4
Silver	5	<5	<5	<5
Thallium	5	<5	<5	<5
Vanadium	100	13.2	14.9	15.1
Zinc	350	25.4	25.8	25.6
<b>Metals (TCLP) - mg/L</b>				
Arsenic	5	<5	<5	<5
Barium	100	0.433	0.285	0.356
Cadmium	1	<1	<1	<1
Chromium	5	<5	<5	<5
Lead	5	<5	<5	<5
Mercury	0.2	<0.2	<0.2	<0.2
Selenium	1	<1	<1	<1
Silver	5	<5	<5	<5

ND - Not detected

Note: Table 1 shows all contaminants with cleanup goals and all volatile and semi-volatile organic constituents that were measured above detection limits.

**Table 2. Emission Limits and Performance Test Results [1]**

		Performance Test Results			
Stack Gas Analyte	Emission Limit	Run 1	Run 2	Run 3	Average
Organic Compounds - Incremental Risk					
Bis (2-chloroethyl) ether	(a)	0.00	0.00	0.00	0.00
Chloroform	(a)	2.78 E-9	2.78 E-9	2.78 E-9	2.78 E-9
Benzene	(a)	8.32 E-10	7.32 E-10	5.65 E-10	7.10 E-10
Total Aggregate Risk	1.5 E-5	1.24 E-6	8.00 E-7	7.35 E-7	9.25 E-7
Metals - Incremental Risk					
Arsenic	1.0 E-6	1.57 E-7	1.75 E-7	9.58 E-8	1.43 E-7
Beryllium	1.0 E-6	2.31 E-7	2.98 E-8	2.32 E-8	9.47 E-8
Cadmium	1.0 E-6	3.08 E-7	1.82 E-7	2.42 E-7	2.44 E-7
Chromium VI	1.0 E-6	4.75 E-7	3.59 E-7	2.81 E-7	3.72 E-7
Nickel	No limit	6.68 E-7	4.94 E-8	9.07 E-8	6.90 E-8
Air Quality Parameters/DRE					
Particulate (gr/dscf corrected to 7% O <sub>2</sub> )	0.03	0.0096	0.0071	0.0070	0.0079
HCl (lb/hr)	1.0	0.0346	0.0238	0.0236	0.0273
SO <sub>2</sub> (lb/hr)	37.5	20.02	4.45	7.96	10.31
CO (ppm <sub>v</sub> )	50	0.0	0.2	0.2	0.13
DRE (%) (c)	99.99	99.9999	99.9998	99.9999	99.99987

(a) Emission rates of carcinogenic compounds not to exceed a cancer risk of 1.5 E-5.

(b) Emission rates of carcinogenic metals (As, Be, Cd, Cr VI) not to exceed a cancer risk of 1.0 E-6, individually.

(c) DRE based on addition of chlorobenzene spike to the feed material; spiked at a concentration of 640 mg/kg chlorobenzene.

### **Performance Data Quality**

Available contaminant concentration data were limited to the performance test. The treatment vendor reported that performance test samples were collected according to a sampling

plan which addressed the collection and analysis of feed soil, treated soil, and stack gas. Samples were collected at 30 minute intervals and analyzed by EPA protocols. Stack sampling and analysis was conducted by ENSR Consulting and Engineering. Soil sampling was conducted by Williams Environmental, and analyzed by Quanterra Environmental Services. No exceptions to analytical results were reported by the treatment vendor.

### **Cost Information [1]**

Cost information, shown in Table 3, was provided by the treatment vendor, and reflect actual costs for the project.

**Table 3 - Actual Project Costs [1]**

Cost Category/Element	Cost (1995 \$ Basis)
<b>1. Capital Cost for Technology</b>	
Technology mobilization, setup, and demobilization	345,000
Planning and preparation	85,000
Site work - preparation/restoration	
Equipment and appurtenances	
Startup and testing	
Other	
<i>TOTAL CAPITAL COSTS</i>	430,000
<b>2. O&amp;M for Technology</b>	
Labor	4,819,792
Materials	Included in labor
Utilities and fuel	Included in labor
Equipment ownership, rental, or lease	Included in labor
Performance testing and analysis	199,500
Other (includes nonprocess equipment overhead and health and safety)	
<i>TOTAL OPERATION AND MAINTENANCE COSTS</i>	5,019,292

<b>3. Other Technology-Specific Costs</b>	
Compliance testing and analysis	
Soil, sludge, and debris excavation, collection, and control	
Disposal of residues	
<b>4. Other Project Costs</b> (response to baghouse fire, caustic consumption, equipment modifications)	632,737
<b>Total cost</b>	5,449,292
<b>Total cost for calculating unit cost</b>	6,082,029
<b>Quantity treated</b>	80,000 Tons
<b>Calculated unit cost</b>	68/Ton
<b>Basis for quantity treated</b>	Soil treated

### Observations and Lessons Learned [1]

The LTTD treated 80,000 tons of soil and sediment contaminated with volatile and semivolatile organic compounds to below cleanup goals in 12 months at a unit cost of \$68 per ton of soil and sediment treated. Ninety-five percent of the soil was treated to below the cleanup goals on the first pass through the desorber, with no re-treatment required. The additional 5% required retreatment prior to disposal.

The presence of elevated levels of sulfur pyrite in soil treated through the desorber caused a fire in the baghouse partway through the project. The fire destroyed the baghouse and delayed completion of the project by five months.

The high moisture content of the soil (20 to 30%) obtained from the marsh limited the throughput, and lime was added to the soil to reduce the moisture content and improve material handling.

### Contact Information

For more information about this application, please contact:

#### EPA Remedial Project Manager (RPM):

Fred Cataneo\*  
 EPA Region 2  
 290 Broadway, 19<sup>th</sup> Floor  
 New York, NY 10007  
 Telephone: (212) 637-4428  
 Fax: (212) 637-4393  
 E-mail: cataneo.fred@epa.gov

#### State Contact:

Joel Leon  
 Bureau of Air Quality Engineering  
 New Jersey Dept. of Environmental Protection  
 P.O. Box 27  
 Trenton, NJ 08625  
 Telephone: (609) 984-3019  
 E-mail: jleon@dep.state.nj.us

#### PRP Contractor:

Philip R. DeLuca  
 Severson Environmental Services, Inc.  
 2749 Lockport Rd.  
 Niagara Falls, NY 14305  
 Telephone: (716) 284-0431  
 E-mail: pdeluca@severson.com

#### Treatment Vendor:

Mark A. Fleri, P.E.\*  
 Vice President  
 Williams Environmental Services, Inc.  
 2075 West Park Place  
 Stone Mountain, GA 30087  
 Telephone: (800) 247-4030/(770) 879-4075  
 Fax: (770) 879-4831  
 E-mail: mfleri@wmsgrpintl.com

\* Indicates primary contacts for this application

### References

1. Mark A. Fleri and Greg Whetstone. Williams Environmental Services, Inc. Lipari Landfill Off-Site Remediation Case Study - Low Temperature Thermal Desorption of Organic-Contaminated Soils. February 1, 2001.
2. EPA. National Priority Site Fact Sheet. Lipari Landfill. September 11, 2000.
3. EPA. EPA Source Site Description. Lipari Landfill Marsh Sediment - OU 3. March 14, 2001.
4. EPA. Record of Decision for Lipari Landfill, Operable Unit 3. July 11, 1988.
5. Mark A. Fleri. Williams Environmental Services, Inc. Comments on Draft Case Study Report. September 19, 2001.
6. Fred Cataneo, EPA. Feedback on Draft Case Study Report. November 8, 2001.

---

**Acknowledgments**

This report was prepared for the U.S. Environmental Protection Agency's Office of Solid Waste and Emergency Response, Technology Innovation Office. Assistance was provided by Tetra Tech EM Inc. under EPA Contract No. 68-W-99-020.

**Appendix A. Maximum Allowable Contaminant Concentrations, per NJ DEP Permit (mg/kg) [5]**

Contaminant	Concentration
Acetone	0.2
Methyl Isobutyl Ketone	0.6
Xylene	0.5
Total Volatile Organic Compounds	2.0
Bis (2-chloroethyl) ether	5.0
Bis (2-ethylhexyl) phthalate	70
Base/Neutral Extractables	72
Arsenic	3.0
Beryllium	0.1
Cadmium	0.5
Chromium	14
Lead	5
Mercury	0.5
Nickel	0.2